

# Putting the Best Foot Forward: Reducing the Risk of Lower Extremity Amputations for Utahns with Diabetes

Public interest in reducing the risk of foot ulcers and unnecessary amputations for people with diabetes is gaining momentum. The U.S. Department of Health and Human Services, in its recent

periodic reporting of national health goals, *Healthy People 2010* (HP2010), highlights this interest. Three of the 17 HP 2010 national objectives for diabetes are directly related to improving the

prevention and treatment of foot ulcers and reducing the risk of unnecessary amputations. This brief report presents national and Utah data related to each of these three objectives.

## Foot Ulcers

### HP2010 Objective 5-9

Reduce the frequency of foot ulcers in persons with diabetes (developmental)

HP2010 Objective 5-9 underscores the importance of reducing the occurrence of foot ulcers among people with diabetes. During their lifetimes, 15 percent of people with diabetes will experience a foot ulcer, and between 14 and 24 percent of those with a foot ulcer will require amputation.<sup>1</sup> About one in nine Utah adults with diabetes reported having foot ulcers (10.7%), a level roughly similar to that of all U.S. adults with diabetes (11.8%).<sup>2,3</sup> Studies have documented that the risk of having ulcers increases in people who have had diabetes for ten years or longer, have poor glucose control and/or have cardiovascular, retinal or renal complications.<sup>4</sup>

Table 1 summarizes findings from three years of combined BRFSS data (2000-2002) on prevalence of foot ulcers. Persons with foot ulcers were defined as those who responded “Yes” to the question, “Have you ever had any sores or

irritations on your feet that took more than four weeks to heal?” It can be seen that the risk of foot ulcers decreases among older adults age 65 and over, but it increases among those on insulin and those with longer duration of diabetes.<sup>2</sup>

In particular, about one in eight Utahns age 18 to 44 (11.9%) and 45 to 64 (11.8%) reported having

ulcers, and about one in eleven (9.2%) had ulcers among those age 65 and over. Utahns more than 20 years post-diagnosis were about three times as likely to have foot ulcers than those less than six years post-diagnosis (20.0% vs. 7.5%). Finally, 13 percent (13.0%) of those using insulin reported having foot ulcers, compared to 9.7% of those not on insulin.

**Table 1.**

Percentage of Utah Adults with Diabetes Who Report Having Foot Ulcers, BRFSS 2000-2002

	N*	Percentage	95% Confidence Interval
Overall	528	10.7	7.7-13.8
Age Group			
18-44	84	11.9	4.2-19.5
45-64	201	11.8	6.9-16.7
65+	240	9.2	4.7-13.7
Diabetes Duration			
Less than 6 years	233	7.5	3.9-11.1
6-10 years	85	8.3	1.9-14.2
11-20 years	121	14.0	6.4-21.5
20+ years	80	20.0	8.4-31.6
Insulin use			
No	369	9.7	6.2-13.3
Yes	159	13.0	6.9-19.0

Foot ulcer is a proxy measure based on reporting having foot sores or irritations taking more than four weeks to heal

Note: Totals within each subcategory may not total to 528 due to missing cases

Note: The smaller numbers in some cells make the percentages less reliable.

Table adapted from “History of Foot Ulcers Among Persons with Diabetes --- United States, 2000—2002” MMWR 52(45):1098-1102 Nov.14 2003

## Lower Extremity Amputation (LEA)

### HP2010 Objective 5-10

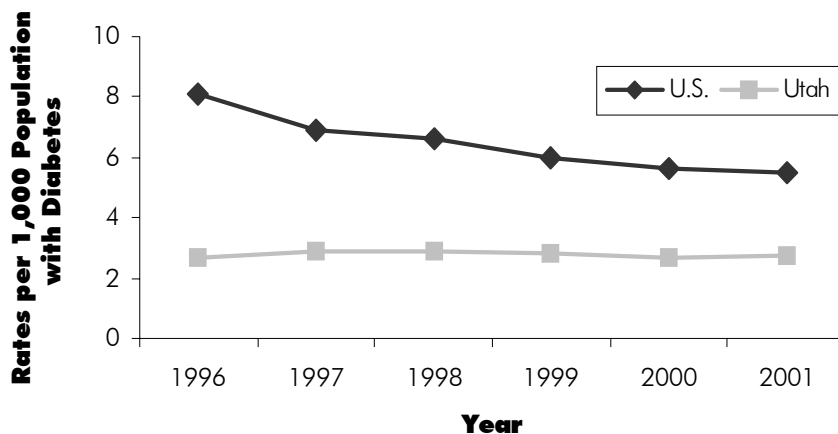
Reduce the rate of lower extremity amputation in persons with diabetes.

HP2010 Objective 5-10 focuses on reducing LEAs for people with diabetes, many of which are preventable. Diabetes accounts for over 60 percent of nontraumatic LEAs in the U.S.<sup>5</sup> While the percentage of people with diabetes who suffer from this devastating complication is relatively small, the impact on quality of life, disability, and suffering is substantial. National data suggest that once a person with diabetes has an amputation, the risk of having a second amputation within three to five years is about 50 percent.<sup>6</sup>

Age-adjusted rates of amputation for people with diabetes in the U.S. and Utah since 1996 are shown in Figure 1. The U.S. age-adjusted amputation rates reached a peak of 8.1 per 1,000 population with diabetes in 1996, after a lengthy period of gradual increase. Subsequently, the U.S. rate trended downward to 5.5 per 1,000 in 2001, a decline of nearly one-third. The 1996 age-adjusted rate for Utah was only 2.7 per 1,000 people with diabetes, about one-third that observed for the U.S. Additionally, while the U.S. rate declined between 1996 and 2001, the Utah rate remained steady. As a result, the Utah-U.S. differential contracted between 1996 and 2001. Nevertheless, the

**Figure 1.**

Age-Adjusted Rates per 1,000 Population with Diabetes for Diabetes-Related LEAs for U.S. and Utah, 1996-2001



Source: Utah Inpatient Hospital Database 1995-2002; Centers for Disease Control and Prevention, Diabetes Surveillance System  
Note: Rates are standardized to the U.S. 2000 population and use 3-year moving averages

**Table 2.**

Crude and Age-Adjusted Rates for Inpatient Hospital Discharges for LEAs per 1,000 Persons with Diabetes, U.S. and Utah\*

	U.S.	Utah
Crude Rate	6.5	3.2
Age-adjusted Rate	5.5	2.7

**Data Sources:** Utah Inpatient Hospital Discharge Database, 2002; Centers for Disease Control and Prevention, National Center for Health Statistics, Division of Health Care Statistics, data from the National Hospital Discharge Survey and Division of Health Interview Statistics, data from the National Health Interview Survey 2001

(See <http://www.cdc.gov/diabetes/statistics/lea/fig3.htm>)

\*Note: Rates for the U.S. are 2001; rates for Utah are the average of rate 2000-2002

Utah rate was still only about one-half the rate for the U.S.<sup>8</sup>

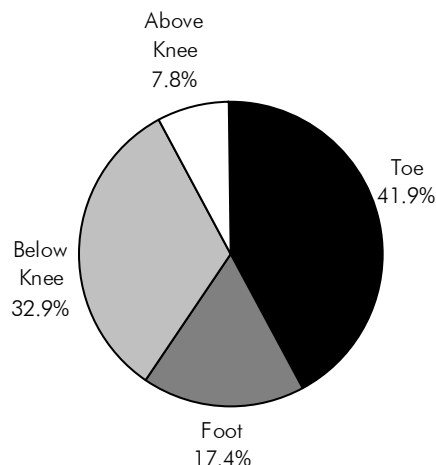
Because the risk of LEAs increases with age, it could be argued that in Utah the younger population accounts for its relatively lower rate. However, as seen in Figure 1, age-adjusted

LEA rates still show substantial and remarkably consistent differences. Furthermore, a contrast of rates for Utah and the U.S. shows the rate of national LEAs is approximately twice the rate for Utah, whether the crude or age-adjusted rate is used (Table 2).

## Lower Extremity Amputation (LEA) Continued

**Figure 2.**

Percentage Distribution of Level of LEA for Utahns with Diabetes, 2001-2002



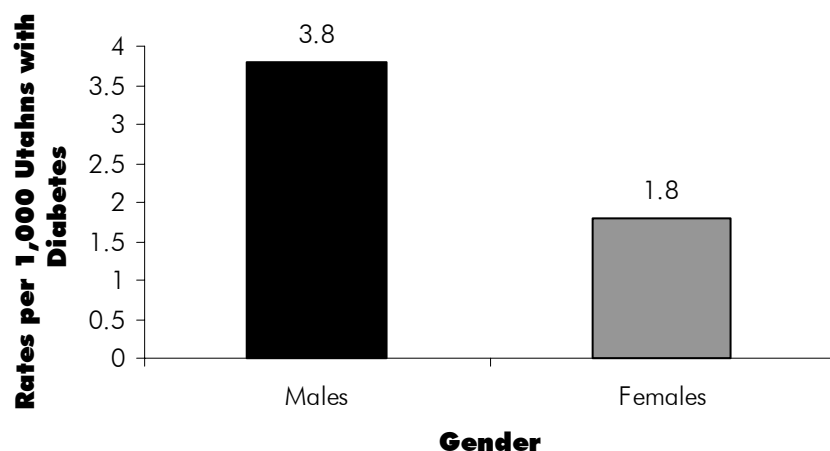
Source: Utah Inpatient Hospital Discharge Database, 2001-2002

The percentage distribution for inpatient hospital discharges in 2001-2002 using four different levels of amputation for people with diabetes is shown in Figure 2.

(NOTE: These percentages are based on the numbers of discharges and do not account for the fact that the same person may have multiple discharges in the same year). About two in five LEAs for people with diabetes in 2001-2002 were toe amputations (41.9%). A number of toe amputations (between 100 and 150 per year for people with diabetes) are also done on an out-patient basis (not shown).<sup>9</sup> The next most common amputations were below the knee, comprising about one-third (32.9%) of amputations among Utahns with diabetes. Less than one in five (17.4%) amputations for Utahns with diabetes were foot amputations. Above-the-knee amputations accounted for the lowest percentage, 7.8% (Figure 2).

**Figure 3.**

Rates of LEA per 1,000 Utahns with Diabetes by Gender, 2002



Source: Utah Inpatient Hospital Discharge Database, 2002

National data indicate that males are two and one-half times as likely to have an LEA as females, 6.0 vs. 2.4 per 1,000 persons with diabetes, respectively.<sup>10</sup> In Utah, the gender difference is somewhat less pronounced, but the pattern is similar. Rates of amputation for Utahns are 3.8 per 1,000 males with diabetes vs. 1.8 per 1,000 females with diabetes (Figure 3).

## Foot Exams

### HP2010 Objective 5-14

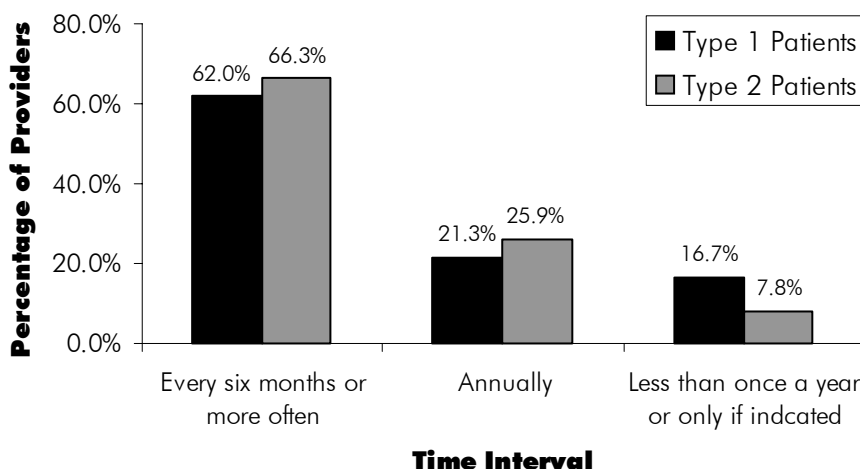
Increase the proportion of adults with diabetes who have at least one annual foot examination.

Regular foot exams conducted by a health care professional are an essential part of diabetes management.<sup>11</sup> Some studies suggest that at least half of all LEAs are preventable through adequate routine care. HP2010 Objective 5-14 sets forth the importance of increasing the proportion of people with diabetes who have at least one professionally conducted foot exam annually.

All individuals with diabetes should have at least one comprehensive foot exam annually (See below). National estimates indicate that only about 55% of people with diabetes have an annual foot exam.<sup>12</sup> In Utah, a substantially higher percentage, 72.8%, of adults with diabetes report having had at least one professionally conducted foot exam in the past 12 months.<sup>13</sup> When ethnic variations are considered, however, Hispanic adults with diabetes are severely underserved in this area. Only 48 percent (48.0%) of Hispanic adults with

**Figure 4.**

Frequency of Utah Providers Who Conduct Foot Exams at Least Twice a Year; at Least Annually, and at Other Time Intervals



Source: Utah Primary Care Provider Survey, 2001

diabetes in Utah report having had a routine foot exam in the past 12 months, compared to 81.4% of non-Hispanic white adults with diabetes.<sup>14</sup> The higher risk of diabetes and related complications for Hispanics is well documented, as is their reduced access to some types of preventive care.<sup>15-16</sup>

The majority of Utah providers report conducting foot exams regularly for their patients with diabetes.<sup>17</sup> Sixty-two percent (62.0%) of providers report routinely conducting foot exams at least twice a year for their type 1 patients, while two-thirds

(66.3%) report routinely conducting foot exams at least twice a year for their type 2 patients (Table 4). Providers were more than twice as likely to report performing foot exams less than once a year for their type 1 diabetes patients than for their type 2 patients (16.7% vs. 7.8%). (Figure 4).

Considerable effort is being made to reduce the rates of all complications for people with diabetes. Amputations are one of the most disabling and devastating consequences of diabetes, yet one of the most preventable.




All individuals with diabetes should receive an annual foot examination to identify high-risk foot conditions. This examination should include assessment of protective sensation, foot structure and biomechanics, vascular status, and skin integrity.

- ADA Clinical Practice Recommendations 2004 P. S63.

## Clinical Resources

### Monofilament Application Instructions

The sensory testing device used with the diabetic foot exam is a nylon filament mounted on a holder that has been standardized to deliver a 10-gram force when properly applied.

Step 1	Step 2	Steps 3-4
 <ol style="list-style-type: none"> <li>1. Use a 10-gram filament to test sensation. The sites to be tested are indicated on the drawings above. Each site should be tested at least twice and use of sham testing is recommended.</li> </ol>	 <ol style="list-style-type: none"> <li>2. Apply the monofilament perpendicular to the skin's surface as shown below. The approach, skin contact, and departure of the filament should be approximately 1.5 seconds in duration. Apply the filament along the perimeter of, NOT on, an ulcer site, callus, scar, or necrotic tissue.</li> </ol>	 <ol style="list-style-type: none"> <li>3. Apply sufficient force to cause the filament to bow into a C-shape as shown above. Do not allow the filament to slide across the skin or make repetitive contact at the test site.</li> </ol>
<ol style="list-style-type: none"> <li>4. Randomize the selection of test sites and time between successive tests to reduce the potential for patient guessing.</li> <li>5. Ask the patient to respond "yes" when the filament is felt. Record the response.</li> </ol>		

### Clinical Screening Techniques

- MEDASONICS Ankle Brachial Index (ABI) Guide  
[http://www.advbiosys.com/ms\\_medasonics\\_ankle\\_brachial.shtml](http://www.advbiosys.com/ms_medasonics_ankle_brachial.shtml)

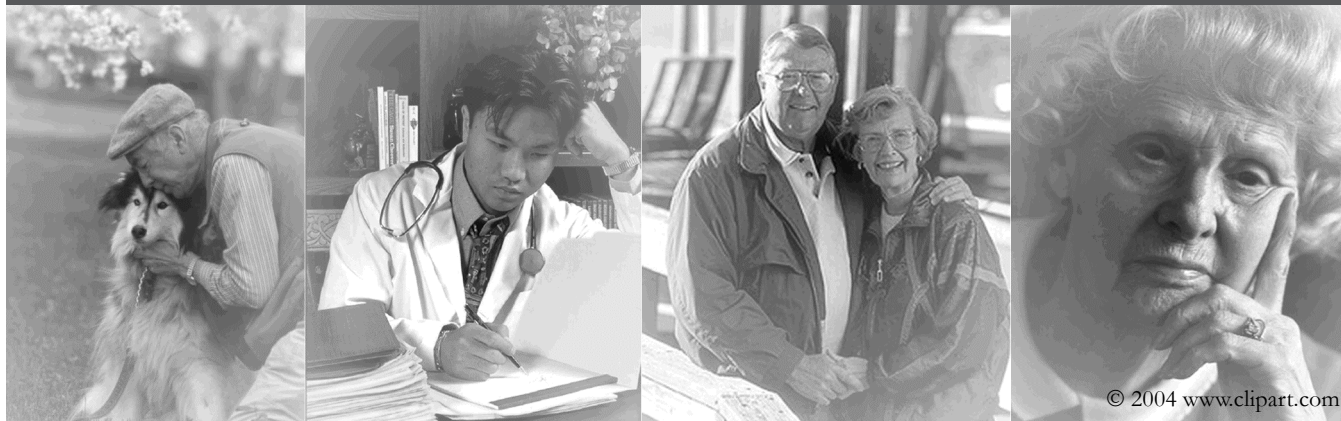
### Clinical Recommendations

- Utah Diabetes Prevention and Control Program, Bureau of Health Promotion, Utah Department of Health, Salt Lake City, UT, Utah Diabetes Practice Recommendations 2004  
(<http://health.utah.gov/diabetes>)
- Intermountain Health Care (IHC) Clinical Education Services, Management of Adult Diabetes, 2003 Update –Developed by the Primary Care Clinical Program and the Diabetes Management Team at IHC

## Other Resources

- The National Diabetes Education Program (NDEP) patient education materials can be found at [http://www.ndep.nih.gov/diabetes/pubs/feet\\_kit\\_eng.pdf](http://www.ndep.nih.gov/diabetes/pubs/feet_kit_eng.pdf)
- CD ROM Helfand, Arthur, E., Charles R. Shuman, Robert L. Lamb, Clarie Surr, Kathleen Dwyer. Assessing the Older Diabetic Foot. A CD developed by the Pennsylvania Diabetes Academy and Temple University School of Podiatric Medicine with funding providing by the Pennsylvania Department of Health. (CME Credit available)
- American Podiatric Medical Association  
[www.apma.org](http://www.apma.org)
- American Orthopaedic Foot and Ankle Society  
[www.aofas.org](http://www.aofas.org)
- American College of Foot and Ankle Orthopedics and Medicine  
[www.acfaom.org](http://www.acfaom.org)
- Centers for Disease Control and Prevention  
[www.cdc.gov/diabetes](http://www.cdc.gov/diabetes)

For more information contact the Utah Diabetes Prevention and Control Program,  
**801-538-6141** or visit the website: <http://health.utah.gov/diabetes>



The production of this document was funded entirely by a grant through the Centers for Disease Control and Prevention No. U32/CCU822702-01. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the CDC. Printed March 2004.



## Technical Notes

Hospital discharges for lower-extremity amputation are defined as any listed ICD-9-CM 250 with a procedure code of 84.1 for nontraumatic amputation of lower limb. Level of amputation uses the definition set forth using ICD-9 procedure codes in the Division of Diabetes Translation, Centers for Disease Control and Prevention: toe (ICD-9 code of 84.11), foot (ICD-9 codes 84.12-84.13), below knee (ICD-9 codes 84.14-84.16), and above knee (ICD-9 codes 84.17-84.19).

All national and state age-adjusted rates use three age categories (Less than 65, 65-74, and 75 and over). In some instances, rates are calculated using three years of combined data (2000-2002) with 2001 as the mid-year population. The population with diabetes is determined from the Utah Health Status Survey, 2001, Center for Public Health Data, Utah Department of Health. Figure 1 shows age-adjusted rates for LEAs weighted to the U.S. standard population. Utah population with diabetes is based on the 1996 and 2001 Utah Health Status Surveys.

Rates of LEAs for people with diabetes shown are per total population. The most recent U.S. estimates (2001) for people with diabetes show a rate of 4.1 LEAs per 1,000 persons with diabetes (age-adjusted to the 2000 US standard population). In Utah, people with diabetes have a much lower rate of LEAs, 2.2 per 1,000 Utahns with diabetes in 2002. Rates use three-year moving averages.

### Data Sources Used in This Report:

Utah Data	National Data
Utah Primary Care Provider Survey, 2001 Utah Hispanic Health Survey, 2001 Utah Health Status Survey, 1996, 2001 Utah Behavioral Risk Factor Surveillance System, 2000-2001 Utah Hospital Discharge Database, 1995-2002 Utah Ambulatory Surgery Database, 2000-2001	National data were computed by CDC Division of Diabetes Translation (DDT), National Center for Chronic Disease Prevention and Health Promotion. Centers for Disease Control and Prevention. National data sources include: National Center for Health Statistics, Division of Health Care Statistics National Hospital Discharge Survey (NHDS) Division of Health Interview Statistics, data from the National Health Interview Survey. U.S. Bureau of the Census Centers for Disease Control and Prevention. Diabetes Surveillance System. (Accessed March 24, 2004 at <a href="http://www.cdc.gov/diabetes/statistics/index.htm">http://www.cdc.gov/diabetes/statistics/index.htm</a> )

## Contributors

Amy Bowler, Information Analyst, Utah Cancer Control Program  
Scott Clark, DPM, Podiatrist, Utah Podiatric Medical Association  
Michael Friedrichs, Epidemiologist, Bureau of Health Promotion  
Linda S. Geiss, Chief Surveillance Section, Division of Diabetes Translation, Center for Disease Control and Prevention  
Robert E. Jones, Aventis Pharmaceuticals  
Kathryn Marti, Research Consultant, Office of Public Health Assessment  
Craig Merrill, Health Plan Specialist, Utah Diabetes Prevention and Control Program  
John Morgan, Information Analyst Supervisor, Office of Health Care Statistics  
Nancy C. Neff, Program Manager, Utah Diabetes Prevention and Control Program  
Kimberly Partain McNamara, Research Consultant/Health Status Survey Coordinator, Office of Public Health Assessment  
Brenda Ralls, Research Consultant, Utah Diabetes Prevention and Control Program,  
Michael Sanderson, Research Analyst, Office of Public Health Assessment  
William F. Stinner, Professor Emeritus, Utah State University  
Randy Tanner, Epidemiologist, Utah Arthritis Program  
Ed Tierney, Epidemiologist, Division of Diabetes Translation, Center for Disease Control and Prevention  
Wu Xu, Office of Health Care Statistics; Executive Secretary, Health Data Committee

## References

1. American Podiatric Medical Association. Facts on Diabetes and the Foot. <http://www.apma.org/faqsdiab.html> - Retrieved 1/3/04
2. History of Foot Ulcer Among Persons with Diabetes—United States, 2000-2002. *MMWR* /52(45); 1098-1102. Nov. 14, 2003
3. Behavioral Risk Factor Surveillance System (2000-2002). Center for Health Data, Utah Department of Health, Salt Lake City, Utah
4. American Diabetes Association. Preventive Foot Care in Diabetes. *Diabetes Care* 27 (Suppl 1) Jan 2004: S63
5. U.S. Department of Health and Human Services. *Healthy People 2010 2nd ed. With Understanding and Improving Health and Objectives for Improving Health*. 2. vols. Washington DC Government Printing Office, November 2000
6. Muller IS, de Grauw WJC, van Gerwen WHEM, Bartelink ML, van den Hoogen HJM and Rutten GEHM. Foot Ulceration and Lower Limb Amputation in Type 2 Diabetic Patients in Dutch Primary Health Care. *Diabetes Care*. 25:570-574, 2002 See also American Podiatric Medical Association. Facts on Diabetes and the Foot.<http://www.apma.org/faqsdiab.html>
7. Data & Trends: Diabetes Surveillance System Nontraumatic Lower Extremity Amputation with Diabetes <http://www.cdc.gov/diabetes/statistics/lea/table7lk.htm> Retrieved 1/10/04
8. Utah Hospital Inpatient Discharge Database (1995-2002). Utah Health Data Committee/Office of Health Care Statistics. Utah Department of Health. Salt Lake City, Utah
9. Utah Ambulatory Surgery Database (2000-2001). Utah Health Data Committee/Office of Health Care Statistics. Utah Department of Health. Salt Lake City, Utah
10. Data are from HP2010 p. 5-22 (Objective 5-10). U.S. Department of Health and Human Services. *Healthy People 2010*. 2nd ed. With Understanding and Improving Health and Objectives for Improving Health . 2 vols. Government Printing Office, November. 2000. See also <http://www.health.gov/healthypeople>
11. American Diabetes Association Position Statement: Standards of Medical Care in Diabetes. *Diabetes Care* 27:S15-S35, 2004
12. This figure represents mean value of data from 39 states in 1998. Data are from HP2010 p. 5-26 and 5-27 U.S. Department of Health and Human Services. *Healthy People 2010*. 2nd ed. With Understanding and Improving Health and Objectives for Improving Health . 2 vols. Government Printing Office, November. 2000. See also <http://www.health.gov/healthypeople>
13. Behavioral Risk Factor Surveillance System (2000-2002). Center for Public Health Data, Utah Department of Health, Salt Lake City, Utah
14. Utah Hispanic Health Survey (2001). Bureau of Health Promotion, Utah Department of Health, Salt Lake City, Utah
15. Harris, MI. "Racial and Ethnic Differences in Health Care Access and Health Outcomes for Adults With Type 2 Diabetes. *Diabetes Care* 24: 454-459, 2001
16. Total prevalence of diabetes by race/ethnicity among people aged 20 years or older, United States, 2002 <http://www.cdc.gov/diabetes/pubs/estimates.htm#complications>-See also : Self-Reported Prevalence of Diabetes Among Hispanics — United States, 1994-1997 *MMWR* 48(01): 8-12. Jan 15, 1999
17. Utahns with Diabetes Survey (2002). Utah Diabetes Prevention and Control Program. Bureau of Health Promotion, Utah Department of Health, Salt Lake City, Utah